Australian Government
Department of Industry, Science, Energy and Resources
National Measurement Institute

NMI R 46-3 Active-energy electricity meters

Part 3: Test report format

June 2022
www.measurement.gov.au

NMI R 46-3
First edition — June 2022

National Measurement Institute
Bradfield Road, Lindfield, NSW 2070

T: +61 2 8467 3600
F: +61 2 8467 3610
W: www.measurement.gov.au

Preface

This document provides the test report format for active-energy electricity meters to accompany NMI R 46-1-2, v1.0 (June 2022) *Active Electrical Energy Meters*.

The test report format is an identical adoption from OIML R 46-3 (2013) *Active Electrical Energy Meters. Part 3: Test report format* published by the International Organisation of Legal Metrology (OIML).

Please refer to NMI R 46-1-2 for all requirements, noting that this is not an identical adoption of OIML R 46-1/-2 (2013), and includes Australian amendments and interpretations.

INTERNATIONAL

RECOMMENDATION

OIML R 46-3

Edition 2013 (E)

Active Electrical Energy Meters.
Part 3: Test report format

Compteurs actifs d'énergie électrique.
Partie 1: Exigences métrologies et techniques
Partie 2: Contrôles métrologiques et essais de performance

OIML R 46-3 Edition 2013 (E)

ORGANISATION INTERNATIONALE
DE METROLOGIE LEGALE

INTERNATIONAL ORGANIZATION
OF LEGAL METROLOGY

Contents

Foreword

The International Organization of Legal Metrology (OIML) is a worldwide, intergovernmental organization whose primary aim is to harmonize the regulations and metrological controls applied by the national metrological services, or related organizations, of its Member States. The main categories of OIML publications are:

- **International Recommendations (OIML R),** which are model regulations that establish the metrological characteristics required of certain measuring instruments and which specify methods and equipment for checking their conformity. OIML Member States shall implement these Recommendations to the greatest possible extent;
- **International Documents (OIML D),** which are informative in nature and which are intended to harmonize and improve work in the field of legal metrology;
- **International Guides (OIML G),** which are also informative in nature and which are intended to give guidelines for the application of certain requirements to legal metrology;
- **International Basic Publications (OIML B),** which define the operating rules of the various OIML structures and systems; and

OIML Draft Recommendations, Documents and Guides are developed by Project Groups linked to Technical Committees or Subcommittees which comprise representatives from OIML Member States. Certain international and regional institutions also participate on a consultation basis. Cooperative agreements have been established between the OIML and certain institutions, such as ISO and the IEC, with the objective of avoiding contradictory requirements. Consequently, manufacturers and users of measuring instruments, test laboratories, etc. may simultaneously apply OIML publications and those of other institutions.

International Recommendations, Documents, Guides and Basic Publications are published in English (E) and translated into French (F) and are subject to periodic revision.

Additionally, the OIML publishes or participates in the publication of **Vocabularies (OIML V)** and periodically commissions legal metrology experts to write **Expert Reports (OIML E)**. Expert Reports are intended to provide information and advice, and are written solely from the viewpoint of their author, without the involvement of a Technical Committee or Subcommittee, nor that of the CIML. Thus, they do not necessarily represent the views of the OIML.

This publication - reference OIML R 46-3, edition 2013 (E) – was developed by OIML TC 12 *Instruments for measuring electrical quantities*. It was approved for final publication by the International Committee of Legal Metrology at its 48th meeting in Ho Chi Minh City, Viet Nam, in October 2013.

OIML Publications may be downloaded from the OIML web site in the form of PDF files. Additional information on OIML Publications may be obtained from the Organization's headquarters:

Bureau International de Métrologie Légale
11, rue Turgot - 75009 Paris - France
Telephone: 33 (0)1 48 78 12 82
Fax: 33 (0)1 42 82 17 27
E-mail: biml@oiml.org
Internet: www.oiml.org

1 Information

1.1 Meter specification

Application no.:	
Meter manufacturer:	
Meter model:	
Serial number(s):	
Meter type (electromechanical/static):	

Accuracy class: ☐ A ☐ B ☐ C ☐ D

Nominal voltage, U_{nom}:		V
Nominal frequency, f_{nom}:		Hz
Maximum current, I_{max}:		A
Transitional current, I_{tr}:		A
Minimum current, I_{min}:		A
Starting current, I_{st}:		A

☐ Direct-connected ☐ Current transformer ☐ Current and voltage transformers

Connection mode (phases, wires, elements):	
Alternative connection mode(s):	
Direction of energy flow / registers:	

☐ Single-register, bi-directional ☐ Single-register, positive direction only

☐ Two-register, bi-directional ☐ Single-register, uni-directional

Register multiplier:		
Meter constant:		*(include units of measurement)*
Specified clock frequencies:		*(include units of measurement)*
Indoor / Outdoor:		
IP Rating:		
Terminal arrangement (eg: BS, DIN):		
Insulation Protection Class:		

Lower specified temperature: ☐ -55 °C ☐ -40 °C ☐ -25 °C ☐ -10 °C ☐ +5 °C

Upper specified temperature: ☐ +30 °C ☐ +40 °C ☐ +55 °C ☐ +70 °C

Humidity class: ☐ H1 ☐ H2 ☐ H3

Tilt / Mounting position: ☐ Mounting position specified ☐ Any position is allowed

Hardware version(s):	
Software version(s):	

Remarks:

1.2 Test values

When ranges of values are specified by the manufacturer, the values used for testing shall be specified below.

Test voltage:		V
Test frequency:		Hz
Test connection mode:		

Remarks:

2 General

2.1 Requirements Checklist

Clause	Description	Passed	Failed	Remarks
3.1	**Units of measurement**			
	Valid units of measurement (Wh, kWh, MWh, GWh)			
3.2; Table 1	**Rated operating conditions (Table 1)**			
	Check I_{max}/I_{tr} ratio complies			
	Check I_{max}/I_{min} ratio complies			
	Check I_{max}/I_{st} ratio complies			
3.4	**Requirements for interval and multi-tariff meters**			
	For interval meters, the summation of interval data shall equate to the cumulative register value over the same period			
	One and only one register (in addition to the cumulative register) shall be active at any time			
	The summation of values recorded in each multi-tariff register shall equate to the value recorded in the cumulative register			
3.6.9	**Checking facility event record**			
	Check any checking facility for sufficient room for events and that it is of the first-in-first-out type.			
3.7.1	**Readability of result**			
	Indicating device is easy to read			
	Height of characters of measurement result ≥ 4 mm			
	All decimal fractions are clearly indicated			
	Able to display all data relevant for billing purposes			
	All registers relevant for billing can store and display energy = $(4000 \cdot U_{nom} \cdot I_{max} \cdot n)$ Wh, where n is the number of phases. (4000 h).			
	For mechanical registers			
	All decimal fraction drums are marked differently			
	For auto-sequencing displays			
	Each register for billing purposes is retained for ≥ 5 s			
	For multi-tariff meters			
	The register which reflects the active tariff is indicated			
	It is possible to read each tariff register locally and each register is clearly identified			
	For electronic registers			
	Retention time for results for a disconnected meter is ≥ 1 year			
	Electronic indicating devices are provided with a display test			
3.7.2	**Testability**			
	The meter is equipped with a test output			
	The wavelength of radiated signals is between 550 nm to 1000 nm.			
	The radiation strength E_T complies with limits at on and off conditions.			

2.2 Timing requirements for interval and multi-tariff meters (3.4)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- Limits shall be determined from IEC 62054-21 based on clock type.

Test	Temperature (°C)	Duration	Result (s/day)	Limit (s/day)
Mains operation	23	30 days		
High temperature:	45	24 hours		
Low temperature:	-10	24 hours		
Operation reserve:	-	36 hours		

- Check that each |result| ≤ |limit|

☐ Passed ☐ Failed

Remarks:

2.3 Storage Period for interval and multi-tariff data (3.4)

Specify Storage Period	Remarks

2.4 Meter Markings (3.5)

Description	**Passed**	**Failed**	**Remarks**
Markings are indelible, distinct and legible from outside the meter			
Serial number affixed in position not readily disassociated from meter			

Meter Marking	**Valid marking on meter?**		**Remarks**
	Yes	**No**	
Manufacturer			
Nominal Voltage U_{nom}			
Maximum current I_{max}			
Transitional current I_{tr}			
Minimum current I_{min}			
Approval mark(s)			
Serial number			
Number of phases			
Number of wires			
Register multiplier (if other than unity)			
Meter constant(s)			
Year of manufacture			
Accuracy class			
Directionality of energy flow (if required)			
Meter type			
Temperature range			
Humidity and water protection information			
Impulse voltage protection information			
Nominal frequency f_{nom}			
The connection mode(s) for which the meter is specified			
Connection terminals uniquely identified to distinguish between terminals			

3 Validation procedure (protection of metrological properties) (4.3; 3.6)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- The two applicable validation procedures are as follows:
- AD: Analysis of the documentation and validation of the design.
- VFTSw: Validation by functional testing of software functions.

Clause	Requirements	Validation Description	Passed	Failed
3.6.2	**Software identification (AD + VFTSw)**			
Specify software identification and means of identification.				
Validate the presentation or display of the software identification.				
Validate that the software identification is inextricably linked to the software				
3.6.3.1	**Prevention misuse (AD + VFTSw)**			
Validate that possibilities of misuse are minimal.				
3.6.3.2	**Fraud protection (AD + VFTSw)**			
Validate that legally relevant software is secured against modification, loading or changes.				
Validate that only clearly documented functions can be activated by the user interface.				
Validate protection/sealing that makes unauthorised access impossible or evident.				
3.6.4	**Parameter protection (AD + VFTSw)**			
Validate that legally relevant characteristics are secured against unauthorised modification.				
The following are considered as modifications to (legally relevant) device-specific parameters. • Zeroing or changing the register for total energy • Zeroing or changing the event record of a checking facility.				
Validate that the meter stops registering energy when modifying a (legally relevant) device-specific parameter.				
Validate (where applicable) a facility to record adjustments to device-specific parameters.				
3.6.5	**Separation of electronic devices and sub-assemblies (AD)**			
Identify the legally relevant part(s) of the meter.				
Validate the separation. Metrologically critical parts of an electricity meter – whether software or hardware parts – shall not be inadmissibly influenced by other parts of the meter.				
3.6.6	**Separation of software (AD)**			
Identify and validate legally relevant software.				
Identify and validate the interface between legally relevant software and other software parts.				
Identify and validate documented interface commands and statement of completeness.				
3.6.7	**Storage of data, transmission via communication systems (AD + VFTSw)**			
Refer to clause 3.6.7 for applicability of these requirements.				
Validate that measurement values stored or transmitted are accompanied by all information necessary for future legally relevant use.				

Clause	Requirements	Validation Description	Passed	Failed
3.6.7.1.2	**Data protection with respect to time of measurement (AD + VFTSw)**			
Validate that software data protection with respect to time of measurement.				
3.6.7.2	**Automatic storing (AD + VFTSw)**			
Validate automatic storage of data.				
Validate sufficient permanency and memory for storage of data.				
Validate deletion of stored data.				
3.6.7.3.1	**Transmission delay (AD + VFTSw)**			
Validate that measurement is not inadmissibly influenced by a transmission delay.				
3.6.7.3.2	**Transmission interruption (AD + VFTSw)**			
Validate measurement data is not lost due to unavailability of network services.				
3.6.7.4	**Time stamp (AD + VFTSw)**			
Validate that time stamps are read from the clock of the device.				
Validate that setting of the clock is protected as a legally relevant parameter.				
3.6.8	**Maintenance and re-configuration (AD)**			
Identify and validate the implementation for software updates.				

4 Tests for maximum permissible error

4.1 Initial intrinsic error for positive and negative flow (6.2.1)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- If a meter is specified with alternate connection modes, this test shall be made for all specified connection modes.

Connection mode:	

I_X: testpoint specified by the national authority between I_{tr} and I_{max}:	
Value of most inductive power factor in test:	
Value of most capacitive power factor in test:	

Positive energy flow					
Test Current (A)	Power Factor	Error (%) with test current from…		Mean error[1] (%)	Base m.p.e. (%)
		Low to high	High to low		
I_{min}	unity				
I_{tr}					
I_X					
I_{max}					
I_{tr}	(most inductive)				
I_X					
I_{max}					
I_{tr}	(most capacitive)				
I_X					
I_{max}					
Negative energy flow					
I_{tr}	unity				
I_{max}					
I_{tr}	(most inductive)				
I_{max}					
I_{tr}	(most capacitive)				
I_{max}					

Note 1: Mean error is the mean of the error with increasing and decreasing currents for each testpoint.

- Check that each |mean error| ≤ |base m.p.e|

☐ Passed ☐ Failed

Remarks:

4.2 Reverse energy flow (6.2.1)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

Calculation for test time for reverse flow		I_{min}	I_{max}
a)	Time that the test output would register ten pulses in the forward energy flow direction (minutes):		
b)	Time that the primary register would register 2 units of the least significant digit in the forward energy flow direction (minutes):		
c)	1 minute:	1	1
	Test time is the maximum of a), b) and c):		

Test Current (A)	Power Factor	Test Time (minutes)	Change in register		Number of test pulses	
			Measured	Limit	Measured	Limit
I_{min}	unity			0		1
I_{max}						

- Check that there is no change in the energy registered in the primary register.
- Check that the number of test pulses emitted ≤ 1.

☐ Passed ☐ Failed

Remarks:

4.3 Self heating (6.2.2)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

Voltage circuits energised for time: [   ] (At least 1 hour for Class A, 2 hours for all other classes.)

- The test shall be carried out for at least 1 hour, and in any event until the variation of error over any 20-minute period does not exceed 10 % of base maximum permissible error.

Test current (A)	Power factor	Time at I_{max} (minutes)	Error (%)	Base m.p.e. (%)	Error shift (%)	Limit (%)
I_{max}	Unity	Intrinsic Error				

Has the error shift levelled out? [   ] If no, continue test according to (a) or (b) below.

(a) If the load can be changed in less than 30 seconds, then:

Test current (A)	Power factor	Intrinsic Error (%)	Error (%)	Base m.p.e. (%)	Error shift (%)	Limit (%)
I_{max}	0.5 inductive					

(b) Else, allow meter to return to its initial temperature and repeat test for power factor 0.5 inductive.

Voltage circuits energised for time: [   ] (At least 1 hour for Class A, 2 hours for all other classes.)

Test current (A)	Power factor	Time at I_{max} (minutes)	Error (%)	Base m.p.e. (%)	Error shift (%)	Limit (%)
I_{max}	0.5 inductive	Intrinsic Error				

- Check that each |error| ≤ |base m.p.e|
- Check that each |error shift| ≤ |limit|

☐ Passed ☐ Failed

Remarks:

4.4 Starting current (6.2.3)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- Determine the error at the starting current based on the rate of test pulses (or revolutions if no test output).

Expected time between pulses, $\tau = 3.6 \times 10^6 / (m \cdot k \cdot U_{nom} \cdot I_{st})$ seconds:	

Test current (A)	Power factor	Meter started (Yes/No)	Error (%)	Base m.p.e. (%)
	Unity			

- Check that the |error| ≤ |base m.p.e|

☐ Passed ☐ Failed

Remarks:

4.5 Test of no-load condition (6.2.4)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

Minimum test period, $\Delta t \geq 100 \times 10^3 / (b \cdot k \cdot m \cdot U_{nom} \cdot I_{min})$ hours:	

Test current (A)	Test period Δt (hours)	For meters with a test output		For electromechanical meters	
		Number of pulses emitted	Limit	Rotor revolutions	Limit
No current			1		Less than a complete revolution

- For meters with a test output, check if the number of pulses emitted ≤ 1.
- For electromechanical meters, check that the rotor does not make a complete revolution.

☐ Passed ☐ Failed

Remarks:

4.6 Meter constants (6.2.5)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

Does the meter have multiple registers or pulse outputs under legal control? (Yes/No)	
If yes, is there a system in place to guarantee identical behaviour of meter constants? (Yes/No)	

If yes, specify the system, otherwise all registers and pulse outputs must be tested.

Register and test output tested:	
Apparent resolution of basic energy register, *R* expressed in Wh:	
Minimum energy to be passed through, $E_{min} = 1000 \cdot R/b$ expressed in Wh:	

Test current (A)	Power factor	Energy measured by		Count of test output pulses	Relative difference (%) $(t-r)/r$	Limit (%) (10% of base m.p.e.)
		Register (r)	Test output (t)			
	Unity					

- Check that each |relative difference| ≤ |limit|

☐ Passed ☐ Failed

Remarks:

5 Tests for influence quantities

5.1 Temperature dependence (6.3.2; Table 3)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- The mean temperature coefficient, *c*, is calculated by $c = (e_u - e_l)/(t_u - t_l)$.
- Temperature intervals shall span at least 15 K and no more than 23 K.
- The set of intervals must span the entire specified operating range (intervals may overlap).
- *A temperature coefficients table must be completed for each temperature interval.*

Temperature coefficients table		Temperature interval (t_l to t_u):	t_l (°C):		t_u (°C):
Test Current (A)	Power factor	Error (%)		Mean temperature coefficient (%/K)	
		e_l	e_u	c	Limit
I_{tr}	unity				
10 I_{tr}					
I_{max}					
I_{tr}	0.5 inductive				
10 I_{tr}					
I_{max}					

- Check that each $|c| \leq |\text{limit}|$.

☐ Passed ☐ Failed

Remarks:

5.2 Load balance (6.3.3)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

This test is only for poly-phase meters and for single-phase three-wire meters.

- Reference voltages shall be applied to all voltage circuits

Test current (A)	Power factor	Load	Error (%)	Error shift (%)	Limit (%)
10 I_{tr}	unity	Balanced			
		Current in L1 only			
		Current in L2 only			
		Current in L3 only			
I_{max}	unity	Balanced			
		Current in L1 only			
		Current in L2 only			
		Current in L3 only			
10 I_{tr}	0.5 inductive	Balanced			
		Current in L1 only			
		Current in L2 only			
		Current in L3 only			
I_{max}	0.5 inductive	Balanced			
		Current in L1 only			
		Current in L2 only			
		Current in L3 only			

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.3 Voltage variation (6.3.4)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- If several U_{nom} values are stated, the test shall be repeated for each U_{nom} value.

U_{nom} (V):					
Test current (A)	Power factor	Voltage variation	Error (%)	Error shift (%)	Limit (%)
10 I_{tr}	unity	Reference (U_{nom})			
		0.9 U_{nom}			
		1.1 U_{nom}			
10 I_{tr}	0.5 inductive	Reference (U_{nom})			
		0.9 U_{nom}			
		1.1 U_{nom}			

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.4 Frequency variations (6.3.5)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- If several f_{nom} values are stated, the test shall be repeated for each f_{nom} value.

f_{nom} (Hz):					
Test current (A)	Power factor	Frequency variation	Error (%)	Error shift (%)	Limit (%)
10 I_{tr}	unity	Reference (f_{nom})			
		0.98 f_{nom}			
		1.02 f_{nom}			
10 I_{tr}	0.5 inductive	Reference (f_{nom})			
		0.98 f_{nom}			
		1.02 f_{nom}			

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.5 Harmonics in voltage and current (6.3.6)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- Determine the error shift, relative to the error at reference conditions (with no harmonics), when the quadriform waveform (Table 11), is applied to both voltage and current circuits.
- Determine the error shift, relative to the error at reference conditions (with no harmonics), when the peaked waveform (Table 12), is applied to both voltage and current circuits.

Test current (A)	Power factor	Harmonics applied to both voltage and current circuits	Error (%)	Error shift (%)	Limit (%)
10 I_{tr}	unity	Reference (f_{nom})			
		Quadriform waveform			
		Peaked waveform			

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.6 Tilt (6.3.7)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

This test is only for electromechanical meters or meters of other constructions that may be influenced by the working position.

Operating position specified by manufacturer:	
Define or illustrate perpendicular orientations corresponding to forward, backward, left and right.	

Test current (A)	Power factor	Tilt	Error (%)	Error shift (%)	Limit (%)
I_{tr}	unity	Reference (no tilt)			
		3° forward			
		3° backward			
		3° left			
		3° right			

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.7 Severe voltage variations (6.3.8)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- If several U_{nom} values are stated, the test shall be repeated for each U_{nom} value.

Test procedure 1

U_{nom} (V):	

Test current (A)	Power factor	Voltage variation	Error (%)	Error shift (%)	Limit (%)
10 I_{tr}	unity	Reference (U_{nom})			
		0.8 U_{nom}			
		0.85 U_{nom}			
		1.15 U_{nom}			

Test procedure 2

Does the meter have distinct shut-down / turn-on voltages? (Yes/No)	
Shut-down voltage (V):	
Turn-on voltage (V):	
If yes, two additional mandatory testpoints (*shutdown low* and *shutdown high*) shall be included. *Shutdown low* shall be within a 2 V range below the shut-down voltage. *Shutdown high* shall be within a 2 V range above the turn-on voltage.	

U_{nom} (V):	

Test current (A)	Power factor	Voltage variation	Error (%)	Error shift (%)	Limit (%)
10 I_{tr}	unity	Reference (U_{nom})			
		0.7 U_{nom}			+10 to -100
		0.6 U_{nom}			
		0.5 U_{nom}			
		0.4 U_{nom}			
		0.3 U_{nom}			
		0.2 U_{nom}			
		0.1 U_{nom}			
		0 U_{nom}			
		shutdown low			
		shutdown high			

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.8 One or two phases interrupted (6.3.9)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

This test is only for poly-phase meters with three measuring elements

- One or two phases are removed while keeping the load current constant.

Test current (A)	Power factor	Load	Error (%)	Error shift (%)	Limit (%)
10 I_{tr}	unity	Reference (no phases removed)			
		Phase L1 removed			
		Phase L2 removed			
		Phase L3 removed			
		Phases L1, L2 removed			
		Phases L1, L3 removed			
		Phases L2, L3 removed			

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.9 Sub-harmonics in the AC current circuit (6.3.10)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- The sub-harmonic waveform is formed from a sinusoidal signal with twice the amplitude of the reference signal, which is switched on and off every second period (as shown in Figure 3 b)).

Test current (A)	Power factor	Current signal	Error (%)	Error shift (%)	Limit (%)
10 I_{tr}	unity	Reference (sinusoidal, f_{nom})			
		Sub-harmonic waveform			

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.10 Harmonics in the AC current circuit (6.3.11)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- The harmonic waveform is formed from a sinusoidal signal with twice the amplitude of the reference signal, which is set to zero during the first and third quarters of the period.

Test current (A)	Power factor	Current signal	Error (%)	Error shift (%)	Limit (%)
10 I_{tr}	unity	Reference (sinusoidal, f_{nom})			
		Harmonic waveform			

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.11 Reversed phase sequence (any two phases interchanged) (6.3.12)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- This test only applies to three-phase meters.

Test current (A)	Power factor	Phase sequence	Error (%)	Error shift (%)	Limit (%)
10 I_{tr}	unity	Reference (L1, L2, L3)			
		L1, L3, L2			
		L2, L1, L3			
		L3, L2, L1			

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.12 Continuous (DC) magnetic induction of external origin (6.3.13)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- Permanent magnet with a surface area of at least 2000 mm^2.
- Field along axis of magnet's core at 30 mm from surface: 200 mT ± 30 mT.
- 6 points per meter surface. Report greatest error shift for each surface.

Specify or illustrate the surfaces designated as front, back, top, bottom, left and right.

Test current (A)	Power factor	Meter surface tested	Error (%)	Error shift (%)	Limit (%)
10 I_{tr}	unity	Reference (no magnetic induction)			
		Front			
		Back			
		Top			
		Bottom			
		Left			
		Right			

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.13 Magnetic field (AC, power frequency) of external origin (6.3.14)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- Continuous field, 400 A/m, $f = f_{nom}$
- Field at three orthogonal directions.
- Report greatest error shift for each test point and direction under the most unfavourable condition of phase.

Specify or illustrate the three orthogonal directions relative to the meter designated as x, y & z:

Test current (A)	Power factor	Magnetic field axis direction	Phase	Error (%)	Error shift (%)	Limit (%)
10 I_{tr}	unity	Reference (no magnetic induction)				
		x-axis				
		y-axis				
		z-axis				
I_{max}	unity	Reference (no magnetic induction)				
		x-axis				
		y-axis				
		z-axis				

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.14 Radiated, radio frequency (RF), electromagnetic fields (6.3.15.1)

Meter serial no.				At start	At end
Observer:			Temperature (°C):		
Date:			Time (hh:mm):		

Meters, such as electromechanical meters, which have been constructed using only passive elements shall be assumed to be immune to radiated radiofrequency fields.

Test Condition 1 – with current

- Frequency range: 80 to 6000 MHz
- Field strength: 10 V/m
- Modulation: 80% AM, 1 kHz sine wave
- The meter shall be separately tested at the manufacturer's specified clock frequencies.
- Any other sensitive frequencies shall also be analysed separately.
- Report greatest error shift for each test condition.

Test current (A)	Power factor	Antenna / facility	Frequency value / range (MHz)	Polarization	Facing meter	Error shift (%)	Limit (%)
10 I_{tr}	unity			Vertical	Front		
					Back		
					Right		
					Left		
					Top		
					Bottom		
				Horizontal	Front		
					Back		
					Right		
					Left		
					Top		
					Bottom		
		[*extend for each antenna/facility*]					
			[*extend for clock frequencies and any other sensitive frequencies*]				

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.15 Immunity to Conducted Disturbances, Induced by Radiofrequency Fields (6.3.15.2)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

Meters, such as electromechanical meters, which have been constructed using only passive elements shall be assumed to be immune to conducted disturbances induced by RF fields.

- Frequency range: 0.15 to 80 MHz
- Field strength: 10 V (e.m.f.)
- Modulation: 80% AM, 1 kHz sine wave
- Test all power ports and I/O ports.
- Report greatest error shift for each test condition.

Test current (A)	Power factor	Power or I/O port	Error shift (%)	Limit (%)
10 I_{tr}	unity			

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.16 DC in the AC current circuit (6.3.16)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

Electromechanical and transformer operated meters shall be assumed to be immune to DC in the AC current circuit.

Test current (A)	Power factor	Current test wave	Error (%)	Error shift (%)	Limit (%)
$I_{max}/2\sqrt{2}$	unity	Sinusoidal (intrinsic error)			
$I_{max}/\sqrt{2}$		Half-wave rectified			

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

5.17 High-order harmonics (6.3.17)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- Asynchronous test signals, swept from f = 15 f_{nom} to 40 f_{nom}.
- Sweep from low frequency to high frequency, and then back down.
- One reading shall be taken per harmonic frequency (report maximum error within the frequency range).
- Report greatest error and error shift for each sweep.

Voltage Circuit Test

- Asynchronous test signal: 0.02 U_{nom}

Test current (A)	Power factor	Signal on voltage circuit	Sweep direction	Error (%)	Error shift (%)	Limit (%)
I_{tr}	unity	Sinusoidal (intrinsic error)				
		Test signal superimposed	low to high			
			high to low			

Current Circuit Test

- Asynchronous test signal: 0.1 I_{tr}

Test current (A)	Power factor	Signal on current circuit	Sweep	Error (%)	Error shift (%)	Limit (%)
I_{tr}	unity	Sinusoidal (intrinsic error)				
		Test signal superimposed	low to high			
			high to low			

- Check that each |error shift| ≤ |limit|.

☐ Passed ☐ Failed

Remarks:

6 Test for disturbances

6.1 Critical change value (6.4.1 a); 3.3.6.2)

- The critical change value is used as a criterion for significant fault in many disturbance tests.

Number of measuring elements, *m*:		
Nominal voltage, U_{nom}:		V
Maximum current, I_{max}:		A
Critical change value ($m \cdot U_{nom} \cdot I_{max} \cdot 10^{-6}$):		kWh

6.2 Magnetic field (AC, power frequency) of external origin (6.4.2)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- Magnetic field strength short duration (3 s): 1000 A/m, $f = f_{nom}$
- Voltage circuits energised with U_{nom}.
- No current in the current circuits.
- Field at three orthogonal directions.

Specify the three orthogonal directions relative to the meter designated as x, y & z:

a) Check for significant fault (see critical change value in 6.1)

Magnetic field axis direction	Change in…		Critical change value
	Register	Equivalent energy of the test output	
x-axis			
y-axis			
z-axis			

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each |change in register| ≤ critical change value.
- Check that each |change in equivalent energy of the test output| ≤ critical change value.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.3 Electrostatic discharge (6.4.3)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

Meters, such as electromechanical meters, which have been constructed using only passive elements shall be assumed to be immune to electrostatic discharges.

- Contact discharge is the preferred test method. Air discharges shall be used where contact discharge cannot be applied.
- Voltage circuits energised with U_{nom}.
- Current and auxiliary circuits open, with no current.

a) Check for significant fault (see critical change value in 6.1)

Application	Discharge mode	Test voltage (kV)	Polarity	Number of discharges (≥ 10)	Change in…		Critical change value
					Register	Equivalent energy of the test output	
Direct	Contact	8	Positive				
			Negative				
	Air	15	Positive				
			Negative				
Indirect, Horizontal coupling plane	Contact	8	Positive				
			Negative				
Indirect, Vertical coupling plane	Contact	8	Positive				
			Negative				

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each |change in register| ≤ critical change value.
- Check that each |change in equivalent energy of the test output| ≤ critical change value.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.4 Fast transients (6.4.4)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

Meters, such as electromechanical meters, which have been constructed using only passive elements shall be assumed to be immune to fast transients.

- The test voltage shall be applied in common mode (line-to-earth) to:
  a) the voltage circuits;
  b) the current circuits, if separated from the voltage circuits in normal operation;
  c) the auxiliary circuits, if separated from the voltage circuits in normal operation and with a reference voltage over 40 V.

a) Check for significant fault (limit of error shift)

Test current (A)	Power factor	Intrinsic Error (%)
10 I_{tr}	unity	

Test current (A)	Power factor	Circuit / Auxiliary circuit	Test Voltage (kV)	Error (%)	Error shift (%)	Limit of error shift (%)
10 I_{tr}	unity	Voltage	4			
		Current				
		[*Auxiliary circuits*]	2			

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each |error shift| ≤ |limit of error shift|.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.5 Voltage dips and interruptions (6.4.5)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

Meters, such as electromechanical meters, which have been constructed using only passive elements shall be assumed to be immune to voltage dips and interruptions.

- Voltage circuits energised with U_{nom}.
- Without current in the current circuit.

a) Check for significant fault (see critical change value in 6.1)

Dip / Interruption	Test	Amplitude relative to U_{nom}	Duration (cycles)	Repetitions	Change in…		Critical change value
					Register	Equivalent energy of the test output	
Dip	Test a	30%	0.5	10			
	Test b	60%	1	10			
	Test c	60%	*[25/30]* [1]	10			
Interruption	-	0%	*[250/300]* [2]	10			

Note [1]: Duration (cycles) for Voltage Dip Test c depends on the reference frequency 25 for 50 Hz, 30 for 60 Hz.
Note [2]: Duration (cycles) for Voltage Interruption Test depends on the reference frequency 250 for 50 Hz, 300 for 60 Hz.

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each |change in register| ≤ critical change value.
- Check that each |change in equivalent energy of the test output| ≤ critical change value.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.6 Radiated, radio frequency (RF), electromagnetic fields (6.4.6)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

Meters, such as electromechanical meters, which have been constructed using only passive elements shall be assumed to be immune to radiated radiofrequency fields.

Test Condition 2 – without current

- Voltage circuits energised with U_{nom}, auxiliary circuits energized with reference voltage.
- Without current in the current circuits and with the current circuits open-circuited.
- Otherwise conditions as specified for the influence test with current in 5.14 above.

a) Check for significant fault (see critical change value in 6.1)

Antenna	Frequency value / range (MHz)	Polariz-ation	Facing meter	Change in…		Critical change value
				Register	Equivalent energy of the test output	
		Vertical	Front			
			Back			
			Right			
			Left			
			Top			
			Bottom			
		Horizontal	Front			
			Back			
			Right			
			Left			
			Top			
			Bottom			
[*extend for each antenna*]						
	[*extend for clock frequencies and any other sensitive frequencies*]					

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each |change in register| ≤ critical change value.
- Check that each |change in equivalent energy of the test output| ≤ critical change value.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.7 Surges on AC mains power lines (6.4.7)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

This test is not applicable for meters such as electromechanical meters which shall be assumed to be immune to surges.

- Without any current in the current circuits and the current terminals open.
- Number of tests: 5 positive and 5 negative
- Repetition rate: maximum 1 per minute

a) Check for significant fault (see critical change value in 6.1)

Amplitude (kV)	Application	Angle	Polarity	Change in…		Critical change value
				Register	Equivalent energy of the test output	
Voltage Circuits						
2	Line to line	60°	Positive			
			Negative			
		240°	Positive			
			Negative			
4	Line to earth (1)	60°	Positive			
			Negative			
		240°	Positive			
			Negative			
Auxiliary Circuits with a reference voltage over 40V *(Repeat table below for each auxiliary circuit)*						
Specify auxiliary Circuit:						
1	Line to line	60°	Positive			
			Negative			
		240°	Positive			
			Negative			
2	Line to earth (1)	60°	Positive			
			Negative			
		240°	Positive			
			Negative			

(1) For cases where the earth of the meter is separate to neutral.

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each |change in register| ≤ critical change value.
- Check that each |change in equivalent energy of the test output| ≤ critical change value.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.8 Damped oscillatory waves immunity test (6.4.8)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

This test is only for meters intended to be operated with voltage transformers.

- Test duration: 60 s (15 cycles with 2 s on, 2 s off, for each frequency)

a) Check for significant fault (limit of error shift)

Test current (A)	Power factor	Mode	Test Voltage (kV)	Test frequency (kHz)	Repetition rate (Hz)	Intrinsic Error (%)	Error (%)	Error shift (%)	Limit of error shift (%)
Voltage Circuits									
20 I_{tr}	unity	Common	2.5	100	40				
				1000	400				
	0.5 inductive			100	40				
				1000	400				
	unity	Differential	1.0	100	40				
				1000	400				
	0.5 inductive			100	40				
				1000	400				
Auxiliary Circuits with a reference voltage over 40V *(Repeat table below for each auxiliary circuit)*									
Specify auxiliary Circuit:									
20 I_{tr}	unity	Common	2.5	100	40				
				1000	400				
	0.5 inductive			100	40				
				1000	400				
	unity	Differential	1.0	100	40				
				1000	400				
	0.5 inductive			100	40				
				1000	400				

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each |error shift| ≤ |limit of error shift|.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.9 Short-time overcurrent (6.4.9)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- For direct connected meters: 30 I_{max} +0%, -10% for one half cycle at rated frequency.
- For meters connected through current transformers: a current equivalent to 20 I_{max} +0%, -10%, for 0.5 s.

a) Check for significant fault (limit of error shift)

Test current (A)	Power factor	Phase	Intrinsic Error (%)
10 I_{tr}	unity	L1	
		L2	
		L3	

Application of overcurrent						After return to normal temperature		
Test current (A)	Power factor	Phase	Short-time overcurrent (A)	Duration	Damage caused?	Error (%)	Error shift (%)	Limit of error shift (%)
10 I_{tr}	unity	L1						
		L2						
		L3						

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each |error shift| ≤ |limit of error shift|.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.10 Impulse Voltage (6.4.10)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- For each test, the impulse voltage is applied 10 times for each polarity. Minimum of 30 s between impulses.
- Specify each circuit tested.

a) Check for significant fault (see critical change value in 6.1)

Test	Impulse Voltage (V)	Polarity	Circuits tested	Flashover, disruptive discharge or puncture?	Change in…		Critical change value
					Register	Equivalent energy of the test output	
For circuits and between circuits		Positive					
		Negative					
Circuits relative to earth		Positive					
		Negative					

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that during the test, there is no flashover, disruptive discharge or puncture.
- Check that each |change in register| ≤ critical change value.
- Check that each |change in equivalent energy of the test output| ≤ critical change value.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.11 Earth Fault (6.4.11)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

This test only applies to three-phase four-wire transformer-operated meters connected to distribution networks which are equipped with earth fault neutralizers or in which the star point is isolated.

- Simulated earth fault condition in one of the three lines.
- All voltages increased to 1.1 U_{nom}.
- Duration: 4 hours.

a) Check for significant fault (limit of error shift)

Test current (A)	Power factor	Intrinsic Error (%)
10 I_{tr}	unity	

Earth-fault condition					After return to normal temperature		
Test current (A)	Power factor	Voltage (V)	Duration (hours)	Damage caused?	Error (%)	Error shift (%)	Limit of error shift (%)
10 I_{tr}	unity	1.1 U_{nom}	4				

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that after the test, the meter shows no damage.
- Check that each |error shift| ≤ |limit of error shift|.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.12 Operation of auxiliary devices (6.4.12)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- Error continuously monitored while auxiliary devices are operated.

a) Check for significant fault (limit of error shift)

Test current (A)	Power factor	Intrinsic Error (%)
I_{tr}	unity	
I_{max}		

Test current (A)	Power factor	Auxiliary Device	Error (%)	Error shift (%)	Limit of error shift (%)
I_{tr}	unity				
I_{max}					
I_{tr}					
I_{max}					

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each |error shift| ≤ |limit of error shift|.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.13 Vibrations (6.4.13.1)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- Meter mounted as in normal operation.
- Vibrations applied, in turn, in three mutually perpendicular axes.

a) Check for significant fault (limit of error shift)

Test current (A)	Power factor	Intrinsic Error (%)
10 I_{tr}	unity	

After vibrations applied				
Test current (A)	Power factor	Error (%)	Error shift (%)	Limit of error shift (%)
10 I_{tr}	unity			

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each |error shift| ≤ |limit of error shift|.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.14 Shock (6.4.13.2)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- Meter not operational during tests.

a) Check for significant fault (limit of error shift)

Test current (A)	Power factor	Intrinsic Error (%)
10 I_{tr}	unity	

After shocks applied				
Test current (A)	Power factor	Error (%)	Error shift (%)	Limit of error shift (%)
10 I_{tr}	unity			

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each |error shift| ≤ |limit of error shift|.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.15 Protection against solar radiation (6.4.14)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

For outdoor meters only.

- Meter condition: non-operational during test.
- Partially mask a section of the meter for later comparison.
- Meter exposed to artificial radiation according to clause 6.4.14.

Visual inspection requirements after exposure		
Clause	**Check for effects on…**	**Remarks**
(3.5) Markings on the meter	Legibility and permanency of markings	
(3.6.1.2) Protection of metrological properties	Seals	
(3.7.1) Readability of result	Transparent surfaces on indicating device	
	Indicating device	
(3.3.6.2; Table 5) No alteration in appearance	Appearance	

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each visual inspection requirement is satisfied.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.16 Protection against ingress of dust (6.4.15)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

Visual inspection requirements after dust test	
Visually inspect interior of meter	**Remarks**
Check if the talcum powder or other dust used in the test has accumulated in a quantity or location such that it could interfere with the correct operation of the equipment or impair safety.	
Check that no dust has deposited where it could lead to tracking along the creepage distances.	

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each visual inspection requirement is satisfied.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.17 Extreme temperatures - Dry Heat (6.4.16.1)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- Meter condition: non-operational.

a) Check for significant fault (limit of error shift)

Test current (A)	Power factor	Intrinsic Error (%)
10 I_{tr}	unity	

Dry Heat Test	
Test temperature (one step higher than upper specified temperature) (°C)	
Duration (hours)	2

After dry heat test				
Test current (A)	Power factor	Error (%)	Error shift (%)	Limit of error shift (%)
10 I_{tr}	unity			

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each |error shift| ≤ |limit of error shift|.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.18 Extreme temperatures - Cold (6.4.16.2)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

- Meter condition: non-operational.

a) Check for significant fault (limit of error shift)

Test current (A)	Power factor	Intrinsic Error (%)
10 I_{tr}	unity	

Cold Test	
Test temperature (one step lower than lower specified temperature) (°C)	
Duration (hours)	2

After cold test				
Test current (A)	Power factor	Error (%)	Error shift (%)	Limit of error shift (%)
10 I_{tr}	unity			

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each |error shift| ≤ |limit of error shift|.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:

6.19 Damp Heat, steady-state (non-condensing), for humidity class H1 (6.4.16.3)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

For humidity class H1 only.

- Voltage and auxiliary circuits energised with reference voltage.
- Without any current in the current circuits.

Damp Heat, steady-state test	
Temperature	30 °C
Humidity	85 %
Duration	2 days

a) Check for significant fault (limit of error shift and see critical change value in 6.1)

Test current (A)	Power factor	Intrinsic Error (%)
10 I_{tr}	Unity	

Change in…	Register	
	Equivalent energy of the test output	
Critical change value		

Immediately after the test, check error shift according to Table 5				
Test current (A)	Power factor	Error (%)	Error shift (%)	Limit of error shift (%)
10 I_{tr}	unity			

b) & c) Operational checks – 24 hours after the test

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e. – 24 hours after the test

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

Checks for damage or corrosion – 24 hours after test

Requirement	Remarks
Check for evidence of any mechanical damage or corrosion which may affect the functional properties of the meter	

- Check that each |change in register| ≤ critical change value.
- Check that each |change in equivalent energy of the test output| ≤ critical change value.
- Check that |error shift| ≤ |limit of error shift| immediately after the test.
- Check all operational checks pass 24 hours after the test.
- Check that |error| ≤ |base m.p.e.| 24 hours after the test.
- Check that the requirements for damage or corrosion are satisfied.

☐ Passed ☐ Failed

Remarks:

6.20 Damp Heat, cyclic (condensing), for humidity class H2 and H3 (6.4.16.4)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

For humidity class H2 or H3 only.

- Voltage and auxiliary circuits energised with reference voltage.
- Without any current in the current circuits.

Damp Heat, cyclic test	
Specified humidity class	
Lower temperature (°C)	25 °C
Upper temperature (°C)	
Duration	2 cycles

a) Check for significant fault (limit of error shift and see critical change value in 6.1)

Test current (A)	Power factor	Initial Error (%)
10 I_{tr}	Unity	

Change in…	Register	
	Equivalent energy of the test output	
Critical change value		

Immediately after the test, check error shift according to Table 5				
Test current (A)	Power factor	Error (%)	Error shift (%)	Limit of error shift (%)
10 I_{tr}	unity			

b) & c) Operational checks – 24 hours after the test

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e. – 24 hours after the test

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

Checks for damage or corrosion – 24 hours after test

Requirement	Remarks
Check for evidence of any mechanical damage or corrosion which may affect the functional properties of the meter	

- Check that each |change in register| ≤ critical change value.
- Check that each |change in equivalent energy of the test output| ≤ critical change value.
- Check that |error shift| ≤ |limit of error shift| immediately after the test.
- Check all operational checks pass 24 hours after the test.
- Check that |error| ≤ |base m.p.e.| 24 hours after the test.
- Check that the requirements for damage or corrosion are satisfied.

☐ Passed ☐ Failed

Remarks:

6.21 Water test (6.4.16.5)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

For humidity class H3 only.

- The meter shall be in functional mode, with no current.

Water test	
Flow rate (per nozzle):	0.07 L/min
Angle of inclination:	0° and 180°
Duration	10 minutes

a) Check for significant fault (see critical change value in 6.1)

Change in…	Register	
	Equivalent energy of the test output	
Critical change value		

Accuracy immediately after the test

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

b) & c) Operational checks – 24 hours after the test

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e. – 24 hours after the test

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

Checks for damage or corrosion – 24 hours after test

Requirement	Remarks
Check for evidence of any mechanical damage or corrosion which may affect the functional properties of the meter	

- Check that each |change in register| ≤ critical change value.
- Check that each |change in equivalent energy of the test output| ≤ critical change value.
- Check that |error| ≤ |base m.p.e.| immediately after the test.
- Check all operational checks pass 24 hours after the test.
- Check that |error| ≤ |base m.p.e.| 24 hours after the test.
- Check that the requirements for damage or corrosion are satisfied.

☐ Passed ☐ Failed

Remarks:

6.22 Durability (6.4.17)

Meter serial no.	
Observer:	
Date:	

	At start	At end
Temperature (°C):		
Time (hh:mm):		

Specify Durability Standard applied:	

Specify details of durability test:

a) Check for significant fault (limit of error shift)

Test current (A)	Power factor	Intrinsic Error (%)
I_{tr}	unity	
10 I_{tr}	unity	
I_{max}	unity	

After durability				
Test current (A)	Power factor	Error (%)	Error shift (%)	Limit of error shift (%)
I_{tr}	unity			
10 I_{tr}	unity			
I_{max}	unity			

b) & c) Operational checks

Test current (A)	Power factor	b) Operational check…	c) Check correct operation of…	
		Does meter register energy?	Pulse outputs?	Tariff change inputs?
	unity			

d) Check base m.p.e.

Test current (A)	Power factor	Error (%)	Base m.p.e. (%)
I_{tr}	unity		
10 I_{tr}	0.5 inductive		

- Check that each |error shift| ≤ |limit of error shift|.
- Check all operational checks pass.
- Check that |error| ≤ |base m.p.e.|.

☐ Passed ☐ Failed

Remarks:
